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Cheng

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(54) **FLARING DEVICE FOR A TUBULAR MEMBER**

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B21D 41/02 (2006.01)

(52) **U.S. Cl.**
CPC ***B21D 41/021*** (2013.01)

(58) **Field of Classification Search**
CPC B21D 41/021; B21D 41/02; B21D 41/025; B21D 39/08
USPC 72/370.06–370.08, 393, 453.01, 453.16
See application file for complete search history.

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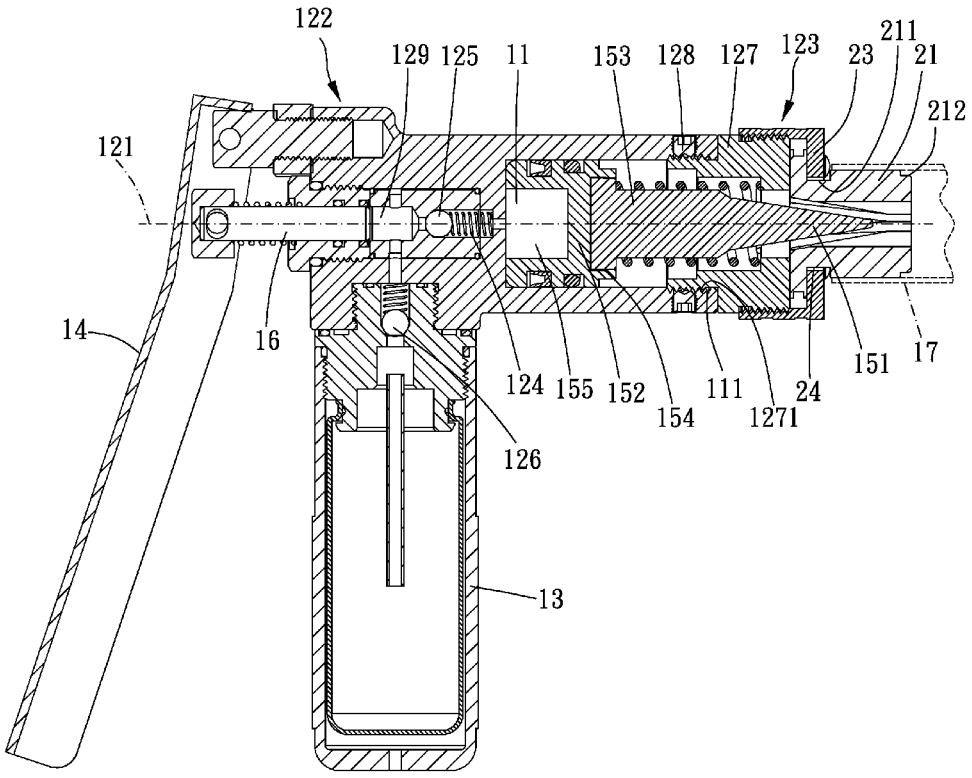
Primary Examiner — Teresa M Ekiert

(57) **ABSTRACT**

A flaring device for flaring a hollow malleable tubular member is provided. A hydraulically powered assembly includes a main body having a cylinder, a lever and a piston member which is received in the cylinder. The main body has an axis and opposing first end and second end. The lever is pivoted on the first end of the main body and operable to drive the piston member to move along the axis. One end of the piston member is formed with a conical expander. The die set is disposed at the second end of the main body and has a plurality of die elements arranged around the axis. The conical expander of the piston member is actuated to move axially and outwardly so as to radially drive the die elements to flare the hollow malleable tubular member.

10 Claims, 9 Drawing Sheets



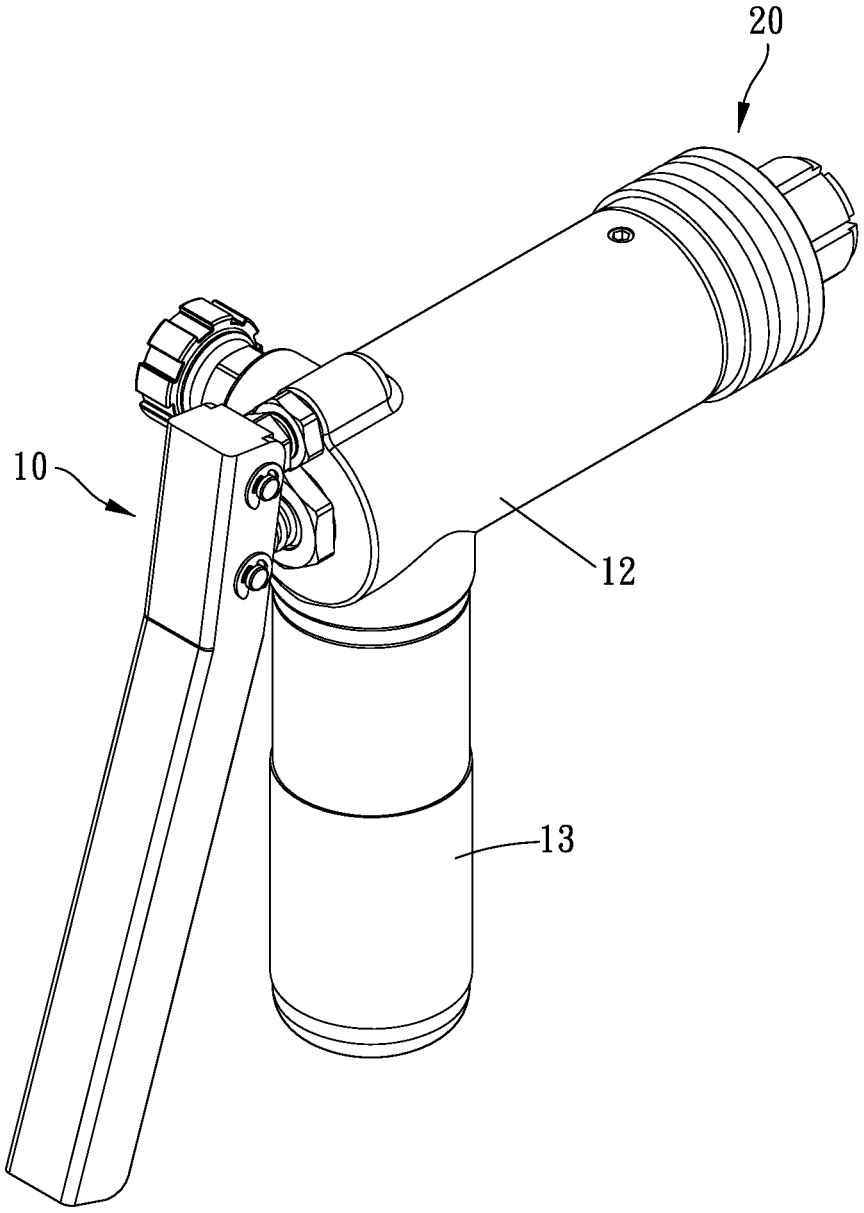


FIG. 1

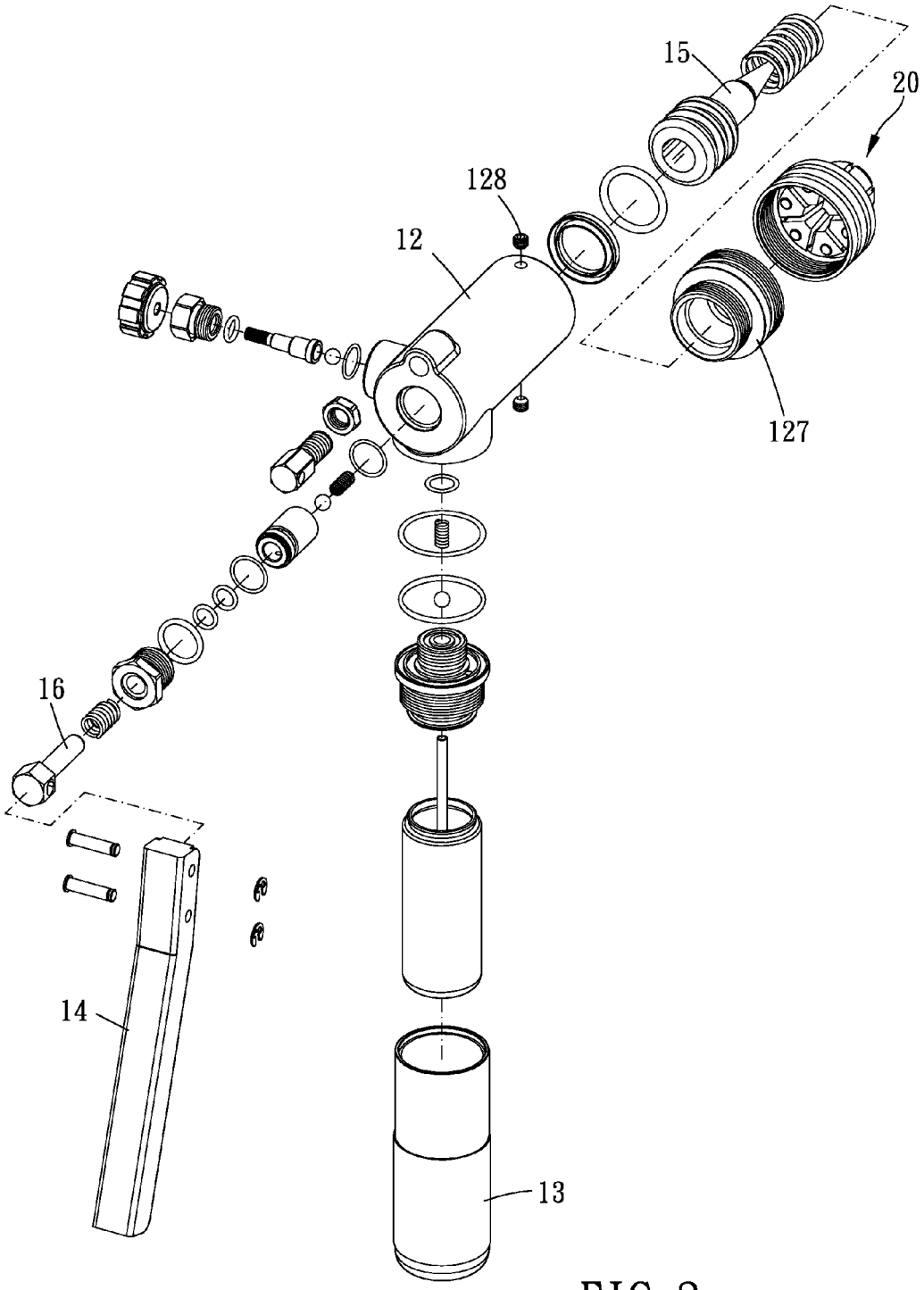


FIG. 2

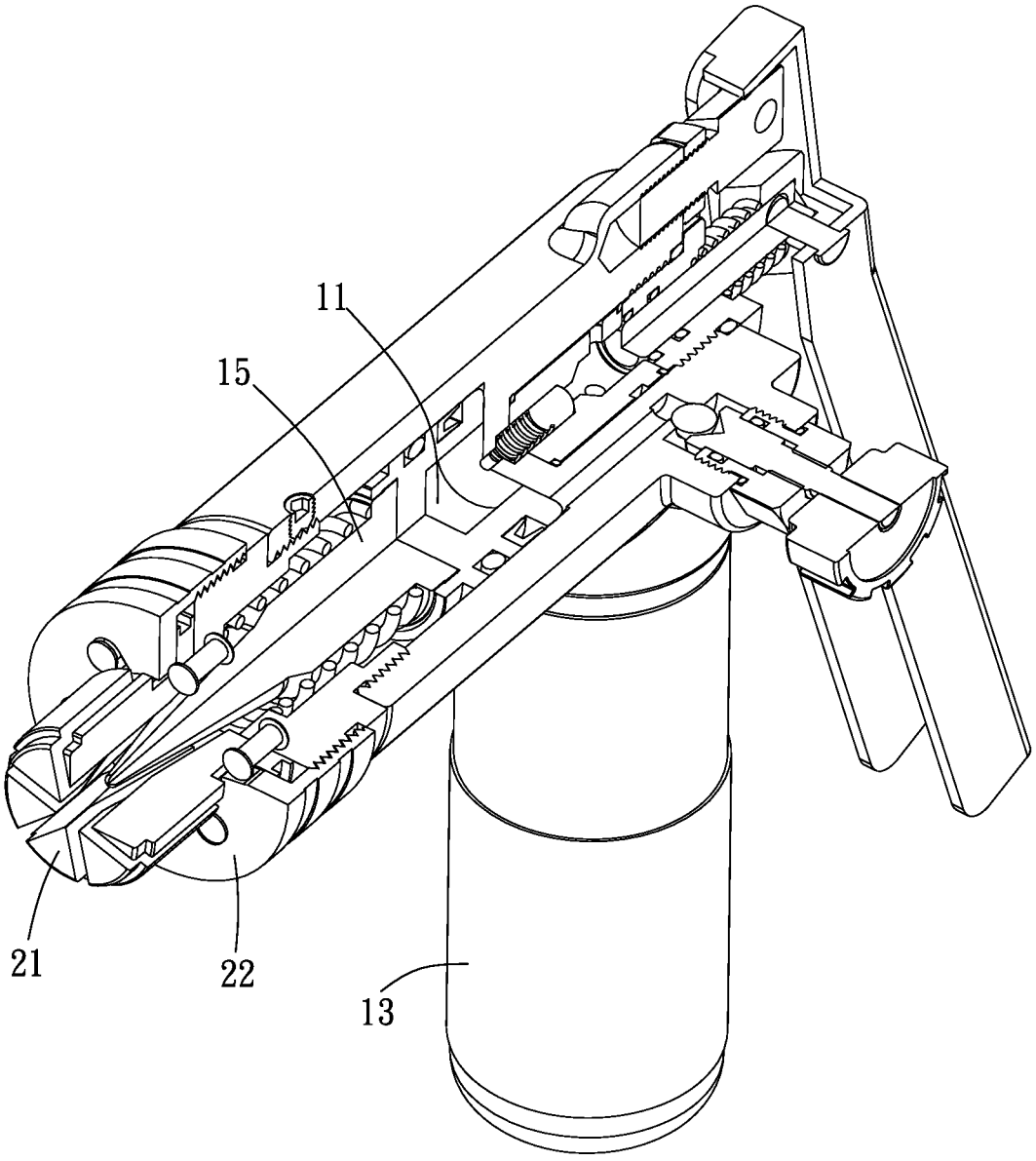
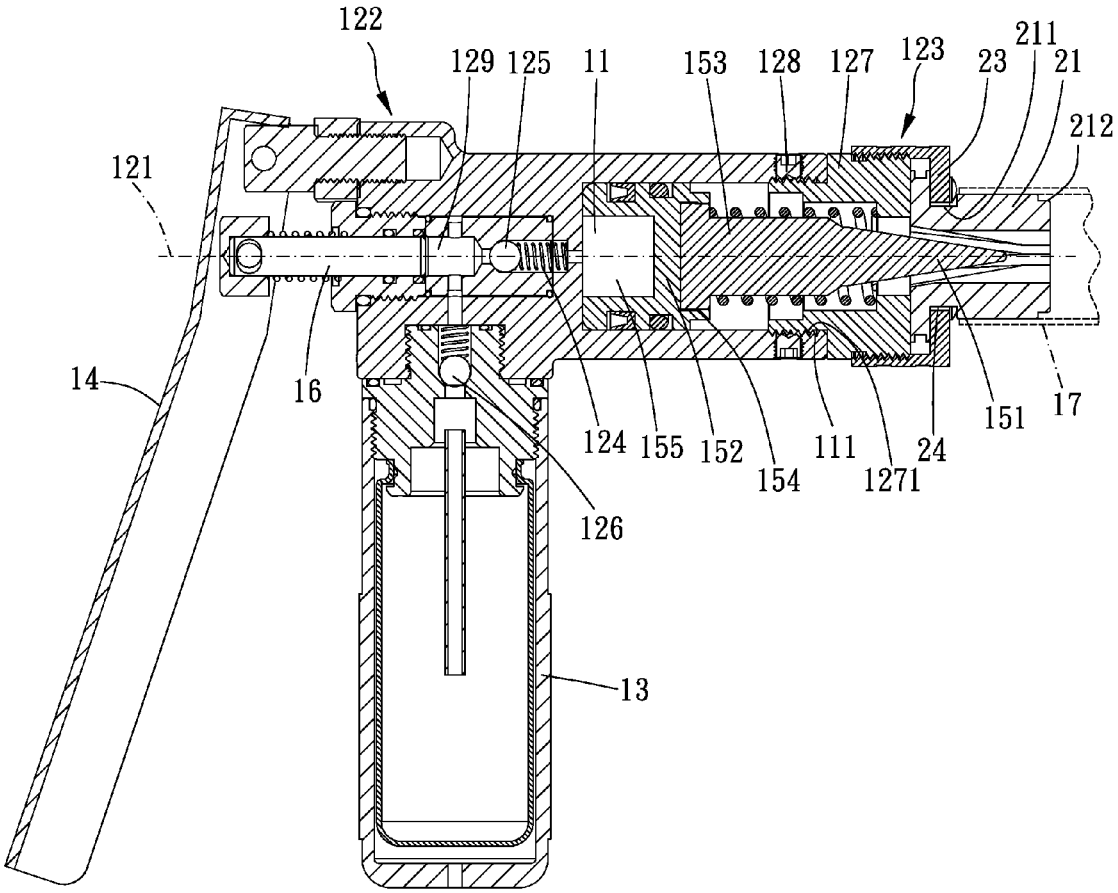


FIG. 3


122
129
125
11
153
128
127
123
23
211
21
212
121
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16
124
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152
154
111
1271
24
151
17
126
13

FIG. 4

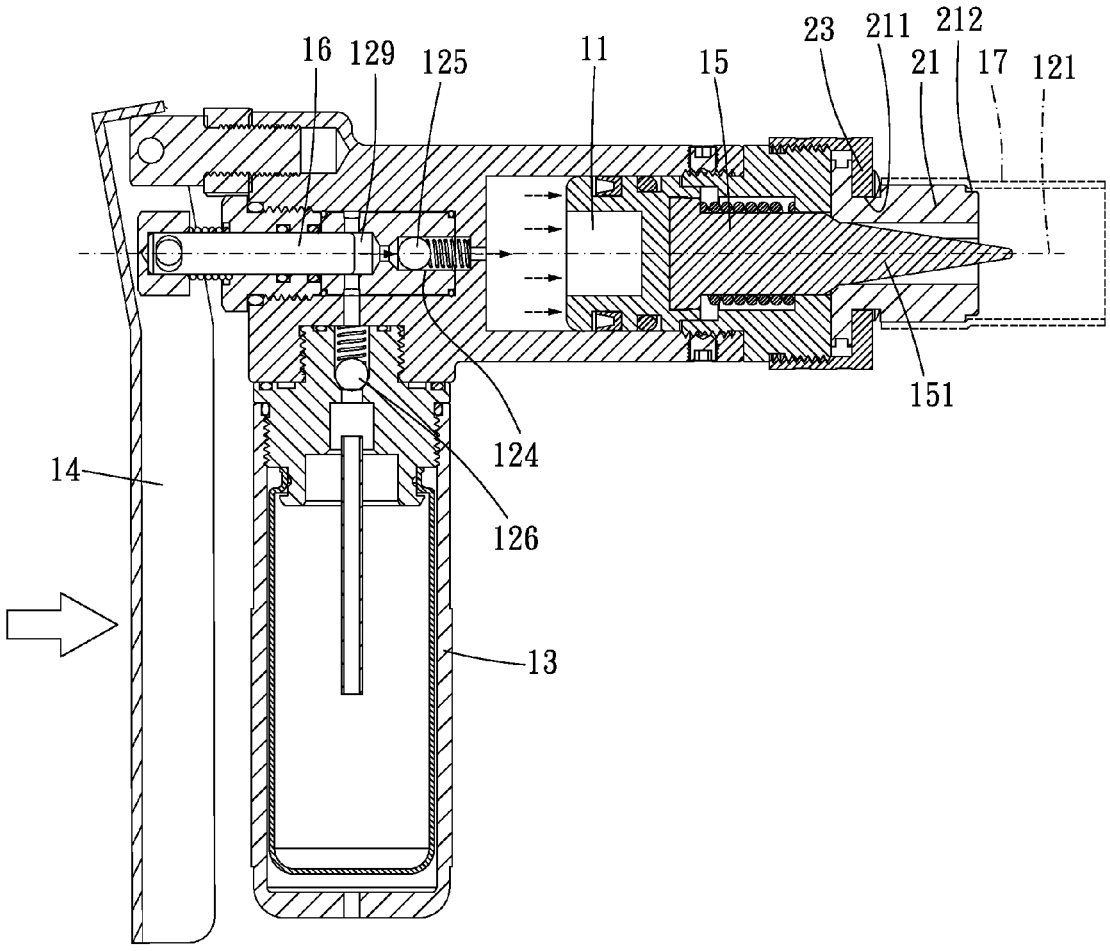

FIG. 5

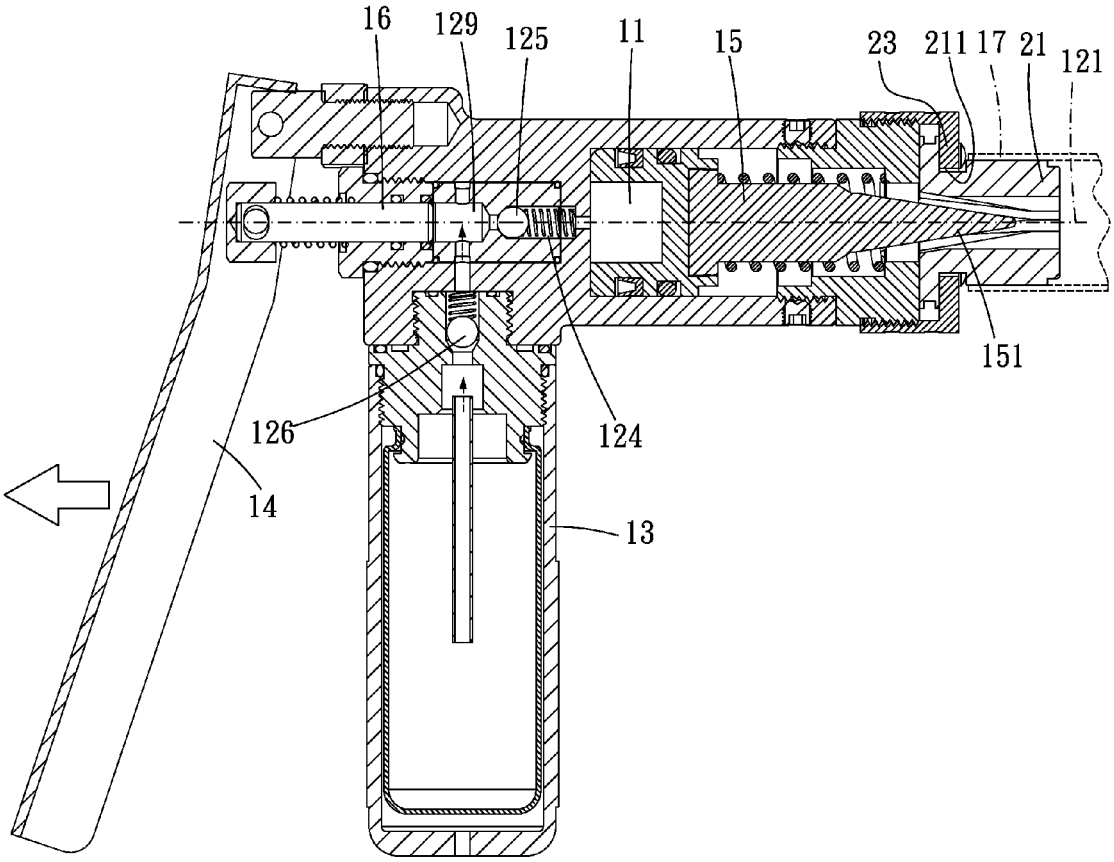

FIG. 6

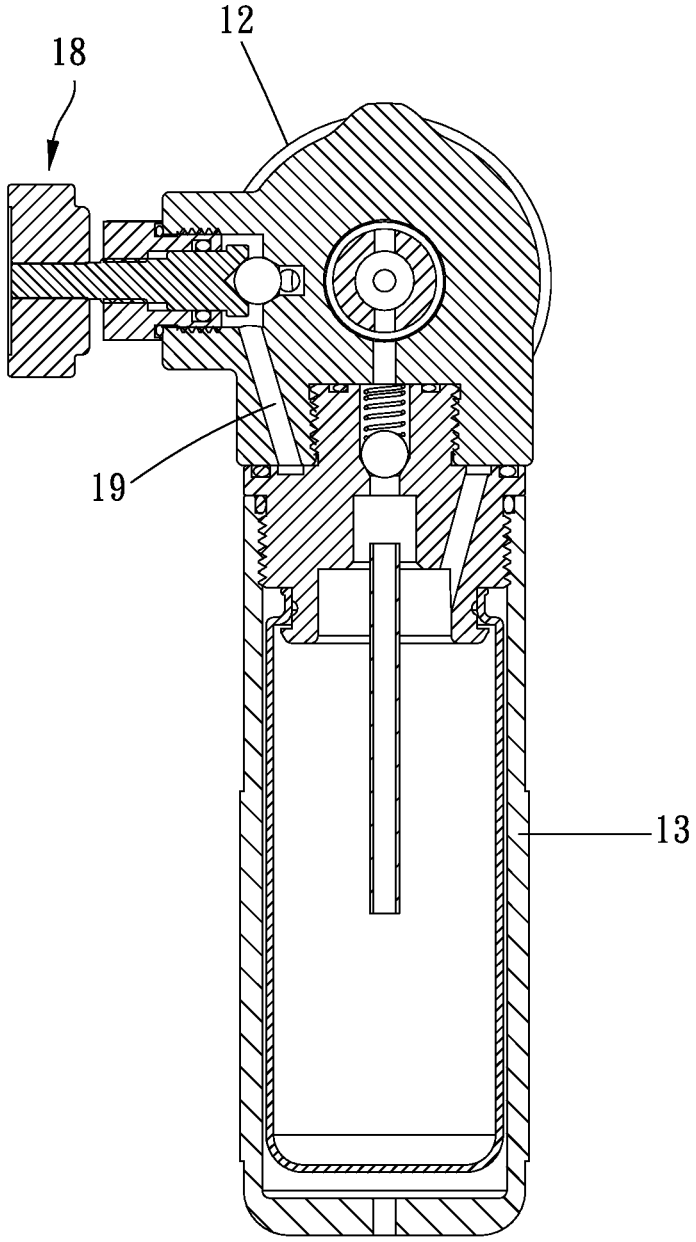

FIG. 7

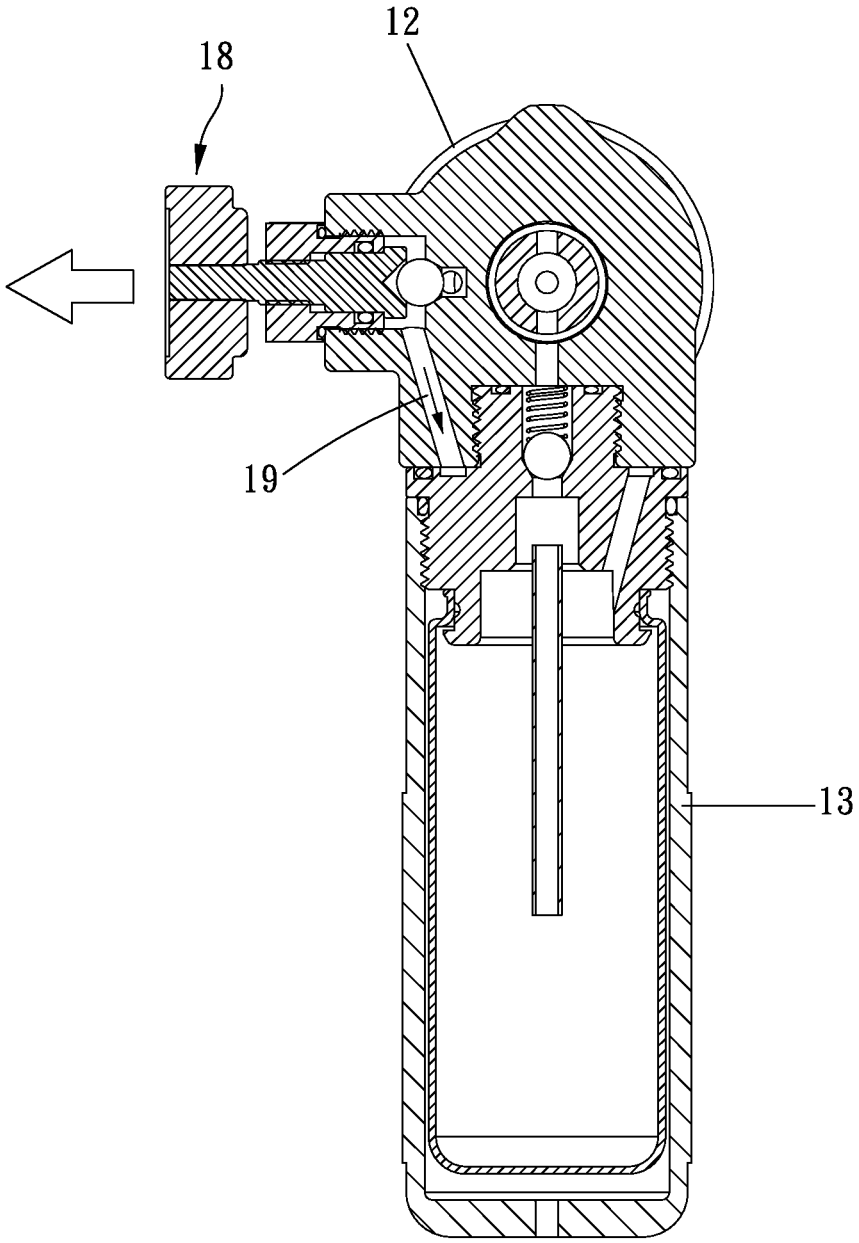

FIG. 8

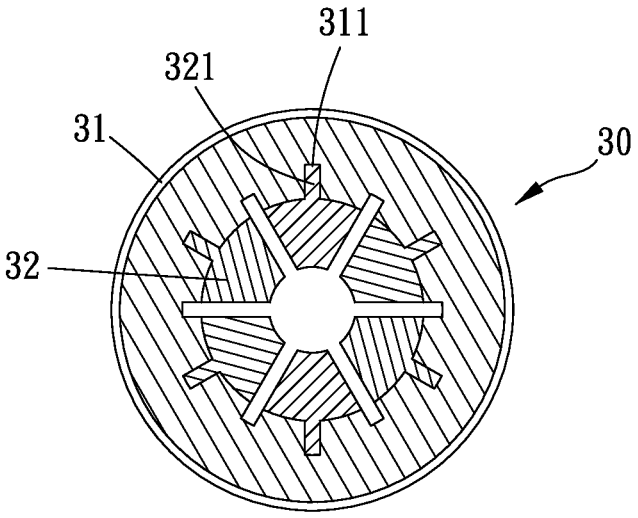

FIG. 9

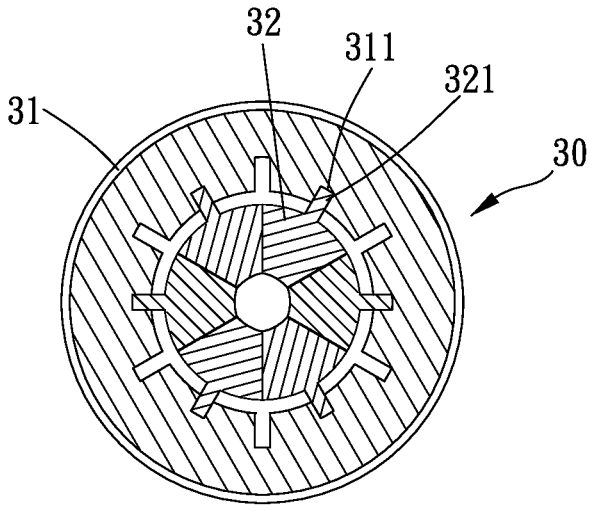

FIG. 10

FLARING DEVICE FOR A TUBULAR MEMBER

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a flaring device for a tubular member.

2. Description of the Prior Art

A conventional flaring device is used to flare one end of a tubular member, so that an opening of the tubular member would be flared and expanded. Thus, the flared tubular members could be connected to each other conveniently.

The conventional flaring device has two opposing conical clipping member disposed thereon. A plurality of expanders is arranged around a periphery of the conical clipping member. A user could operate the conventional flaring device to reduce a distance between the two conical clipping members, so that a conical surface of the conical clipping member would push the expanders to move outwardly for flaring and expanding an internal wall of the tubular member.

Clearly, the conventional flaring device includes a screw rod is movably screwed between the two conical clipping members. The two conical clipping members would be approached to or away from each other via rotating the screw rod. When the screw rod is rotated, one conical clipping member is moved by said rotation; another conical clipping member is rotated relative to the screw rod, so that the two conical surfaces are rotated relative to each other. However, the conventional flaring device is inconveniently to operate, and said rotation of the screw rod for the two conical clipping members to approach to or be away from each other, is laborious and tardy. Therefore, the two conical surfaces rotated relative to each other would apply a torsion onto the two expanders to cause a non-uniform expansion.

A further conventional flaring device includes a body having a handle bar disposed thereon. By using the lever rule, the handle bar could drive a conical faring pusher to move outwardly for flaring a tubular member. However, the further conventional flaring device could be only operated by applying a hand press. Regardless of the thickness of the tubular member, a user needs to apply a strong force to drive the further conventional flaring device. Therefore, a flaring efficiency of the further conventional flaring device is bad, and if the tubular member has a thick tubular wall, the thick tubular wall could not be flared.

The present invention is, therefore, arisen to obviate or at least mitigate the above mentioned disadvantages.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a flaring device for a tubular member, in which the flaring device could provide a proper handle length for a user to operate or effort easily so as to get a better flaring efficiency. Furthermore, the flaring device is convenient for the user to detach, replacement, repair, produce and store. Moreover, the flaring device could prevent a flaring portion of the tubular member from non-uniformly being flared for avoiding an irregularly flaring result. Thus, the flaring device could provide variable flaring sizes for the tubular member, or/and selectively to flare the tubular member gradually.

To achieve the above and other objects, a flaring device for flaring a hollow malleable tubular member is provided. The tube flaring device includes a hydraulically powered assembly and a die set. The hydraulically powered assembly includes a main body having a cylinder, a lever and a piston member which is received in the cylinder. The main body has an axis and opposing first end and second end located on the axis. The lever is traverse to a direction in which the axis extends and pivoted on the first end of the main body, and the lever is operable to drive the piston member to move along the axis. One end of the piston member is formed with a conical expander. The die set is disposed at the second end of the main body and has a plurality of die elements arranged around the axis. The conical expander of the piston member is actuated to move axially and outwardly so as to radially drive the die elements to flare the hollow malleable tubular member.

The present invention will become more obvious from the following description when taken in connection with the accompanying drawings, which show, for purpose of illustrations only, the preferred embodiment(s) in accordance with the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a first embodiment of a flaring device according to a preferred embodiment of the present invention;

FIG. **2** is an exploded perspective view of the present invention;

FIG. **3** is a partial perspective view of the present invention;

FIG. **4** is a cross-sectional view of the present invention for showing an oil-return passage is communicated with a liquid container;

FIGS. **5-6** are cross-sectional views of the present invention for showing the flaring device is operated;

FIG. **7** is a cross-sectional view of the present invention for showing an oil-return passage is communicated with a liquid container;

FIG. **8** is a cross-sectional view of the present invention for showing a liquid flows from the oil-return passage to the liquid container;

FIG. **9** is a cross-sectional view of a second embodiment of the present invention; and

FIG. **10** is a cross-sectional view of a third embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. **1-4** show a flaring device according to a preferred embodiment of the present invention. The flaring device is used to flare a hollow malleable tubular member and includes a hydraulically powered assembly **10** and a die set **20**.

The hydraulically powered assembly **10** includes a main body **12** having a cylinder **11**, a liquid container **13**, a lever **14** and a piston member **15** received in the cylinder **11**.

The main body **12** has an axis **121**, a first end **122** and a second end **123**. The first end **122** and the second end **123** are located on the axis **121** and are opposite to each other. The liquid container **13** is traverse to a direction in which the axis **121** extends (such as vertical to the axis **121**) and radially extended from the main body **12**, so that the flaring device could provide a proper hold length for operating with one hand. Clearly, the liquid container **13** controllably communicates with the cylinder **11** in fluid flowing relationship. A fluid passage **124** is formed between the cylinder **11** and the liquid container **13**. A first unidirectional valve **125** which is adjacent to the cylinder **11** and a second unidirectional valve **126** which is adjacent to the liquid container **13** are both disposed at the fluid passage **124**. A pressed liquid could selectively flow into the cylinder **11** or not, via operating the first unidirectional valve **125** and the second unidirectional valve **126**.

Preferably, the liquid container **13** is detachably assembled to the main body **12** for a user to detach, replace, repair, produce or store conveniently. The liquid container **13** could be integrated with the main body **12**.

The second end **123** of the main body **12** has a connecting portion **127** non-rotatably assembled to the cylinder **11**. The die set **20** is disposed on one end of the connecting portion **127**. Clearly, an external screw portion **1271** is formed on one end of the connecting portion **127**. An internal screw portion **111** is formed on an internal wall of the cylinder **11**. The external screw portion **1271** is screwed to the internal screw portion **111**. At least one fastener **128** (such as a bolt) is radially screwed through the internal screw portion and abutted against the external screw portion, so that the connecting portion **127** could not be rotated relative to the cylinder **11**. Therefore, the connecting portion **127** is prevented from being moved easily and influencing a relative positioning of the die set **20** to the axis **121**. Conceivably, a connecting mode between the connecting portion **127** and the cylinder **11** is not limited by above description. For example, the connecting portion **127** could be screwed at an external position of the cylinder **11** or the connecting portion **127** could be fixedly welded to the cylinder **11**.

The lever **14** is traverse to the axis **121** (the lever **14** would be inclined relative to the axis **121** for the user to smoothly press the lever **14**). One end of the lever **14** is pivoted on the first end **122** of the main body **12**, so that the user could conveniently operate the lever **14** (such as pressed with one hand) for a better flaring efficiency. The lever **14** is operable to drive the piston member **15** to move along the axis **121**. One end of the piston member **15** is formed with a conical expander **151**. Clearly, the lever **14**, is obliquely extended from the first end **122** of the main body **12** and is gradually distant from the liquid container **13**. One end of a recoverable plunger **16** is pivoted on the lever **14** and another end of the plunger **16** is inserted into an active passage **129** of the first end **122** of the main body **12**. The active passage **129** communicates with the fluid passage **124**. The plunger **16** is used to press the pressed liquid into the cylinder **11**.

In the present embodiment, the piston member **15** includes a plug portion **152** and a body portion **153** extended from the plug portion **152** toward the die elements **20**. The conical expander **151** is integrated with the body portion **153** or detachably assembled to the body portion **153**. The plug portion **152** is detachable from the body portion **153** (such as fastening or screwing, but not being limited as above) for the user to detach, replace, repair, produce and store conveniently. The plug portion **152** could be integrated with the body portion **153** in other embodiment of the present invention.

The plug portion **152** is entirely received within the main body **12** and the body portion **153** extends from the plug portion **152** toward the die elements **20**. The conical expander **151** is disposed on the body portion **153**. The plug portion **152** includes first and second recesses **154**, **155** at opposite ends thereof along the axis **121**, the body portion **153** is detachably assembled in the first recess **154** within the main body **12**, and the second recess **155** is open toward the first end **122**. The first recess **154** has a depth less than that of the second recess **155**, and the first recess **154** has a width greater than that of the second recess **155**.

Referring to FIGS. **5-6**, the user could once or repeatedly press the lever **14** toward the liquid container **13** for driving the plunger **16** to move toward the cylinder **11**. The plunger **16** presses the pressed liquid in the active passage **129** and the fluid passage **124** to open the first unidirectional valve **125**, so that the pressed liquid is allowed to flow into the cylinder **11**. Thereafter, the pressed liquid pushes the piston member **15** to move toward the die element **21**, and the conical expander **151** of the piston member **15** would outwardly move to radially push the die elements **21** for flaring the hollow malleable tubular member **17**. When the lever **14** and plunger **16** is pushed by a spring to recover, the plunger **16** would backwardly move and form an attract force to open the second unidirectional valve **126**, so that the liquid is flowed from the liquid container **13** into the active passage **129** and the fluid passage **124** for resupplying. Therefore, the user could operate the present invention again.

Owing to the recess **211** is formed on the periphery of each die element **21** and at least one portion of the annular wall **23** is extended radially inwardly into the recess **211**, so that the die elements **21** would not be easily moved or escaped from the die element supporter **22** before starting a flaring work. In the process of the flaring work, the recess **211** corresponds to the annular wall **23**, so that the die elements **21** would not easily be moved and the die elements **21** would not be swung relative to the axis **121** so as to avoid a flaring segment of the hollow malleable tubular member **17** being uniformly flared.

Referring to FIGS. **7-8**, when finishing the flaring work, a control assembly **18** which disposed on the main body **12** could drive the cylinder **11** to communicate with the liquid container **13** via an oil-return passage **19**, so that a pressure of the cylinder **11** is released for returning the piston member **15** (such as via a spring). Thereafter, the die elements **21** could be inwardly moved to be escaped from the hollow malleable tubular member **17**. Conceivably, the control assembly **18** could be any valve structures, and the control assembly **18** could include a plurality of functions to limit the lever **14**, the piston member **15**, plunger **16**, the first unidirectional valve **125**, or/and the second unidirectional valve **126**.

Referring to FIGS. **9-10**, a second and a third embodiment show that at least one first positioning structure **311** is disposed on a periphery of a further through hole of a further die element supporter **31** of a further die set **30**. At least one of a plurality of die elements **32** of the die set **30** has at least one second positioning structure **321** disposed radially thereon. The first positioning structure **311** corresponds to the second positioning structure **321**, and the first positioning structure **311** and the second positioning structure **321** are circumferentially limitably movable and blockable via abutting against with each other.

In the second and third embodiments of the present invention, a plurality of first positioning structures **311** is uniformly arranged along the further through hole of the further die element supporter **31**. The first positioning structures **311** are radially formed grooves. Each further die element **32** has the second positioning structure **321** formed on the periphery thereof, and the second positioning structure **321** is a rib panel which has a thickness corresponded to a width of the groove. Preferably, the grooves are sorted as a plurality of equiangular arranged groups. The grooves of each group have a same radial depth, and the grooves of different groups have a different radial depth. When the rib panels are abutted against the corresponded grooves of one group, a plurality of constructional circles which have a one diameter is formed on the periphery of the further die elements **32**; when the rib panels are abutted against the corresponded grooves of another group, a plurality of constructional circles which have an another diameter is formed on the periphery of the further die elements **32**. Referring to FIG. **9**, the radial depth of the groove is equal to the thickness of the rib panel (or a little larger than the thickness of the rib panel), so that the periphery of the further die element **32** is able to be abutted against the periphery of the further die element supporter **31**. Therefore,

the constructional circle which is formed on the periphery of the further die element **32** has a longer diameter. Referring to FIG. **10**, the radial depth of the groove is smaller than the thickness of the rib panel. When the rib panel is abutted against a bottom of the corresponded groove, a distance is formed between the periphery of the further die element **32** and the periphery of the further die element supporter **31**, so that the constructional circle which is formed on the periphery of the further die element **32** has a shorter diameter. Thus, the present invention could provide variant flaring levels or/and choose gradual-flaring efficiency via plugging the rib panels into the grooves of the different groups.

Referring to FIGS. **4-5**, the radial tapered portion **212** is formed on the periphery of one end of each die element **21** which is remote from the main body **12**. Preferably, the radial tapered portion **212** is formed as smooth arc-shaped, so that the hollow malleable tubular member **17** would not be damaged by the radial tapered portion **212**, and a transitional portion between a flaring portion and a non-flaring portion of the hollow malleable tubular member **17** would not be damaged or/and reduce a structure strength by a punchy flaring force. Moreover, the die element **21** would not be jammed to the hollow malleable tubular member **17**, so that the die element **21** could be easily removed from the hollow malleable tubular member **17** after the flaring work.

Under above arrangement, the liquid container **13** is traverse to the axis **121** and extended from the main body **12**, and/or the lever **14** is traverse to the axis **121** and pivoted to the main body **12**, so that the flaring device could provide a proper hold length for operating, and the user could conveniently operate the lever **14** for a better flaring efficiency.

Besides, the liquid container **13** is detachable from the main body **12** for a user to detach, replace, repair, produce and store conveniently.

The conical expander **151** is integrated with the body portion **153** or detachable from the body portion **153**, or/and the plug portion **152** is detachable from the body portion **153** for the user to detach, replace, repair, produce and store conveniently.

The recess **211** is formed on a periphery of each die element **21**, and the annular wall **23** is at least partially extended into the recess **211**. In the process of the flaring work, the recess **211** corresponds to the annular wall **23**; the die elements **21** would not be easily moved, and the die elements **21** would not be swung relative to the axis **121**, so as to avoid a flaring segment of the hollow malleable tubular member **17** being uniformly flared.

Furthermore, the first positioning structure **311** and the second positioning structure **321** are respectively formed on the further through hole of the further die element supporter **31** and the further die element **32**, so that the present invention could provide variant flaring levels or/and choose gradual-flaring efficiency

Although particular embodiments of the invention have been described in detail for purposes of illustration, various modifications and enhancements may be made without departing from the spirit and scope of the invention. Accordingly, the invention is not to be limited except as by the appended claims.

What is claimed is:

1. A flaring device for flaring a hollow malleable tubular member comprising:

a hydraulically powered assembly including a main body having a cylinder, a lever and a piston member which is received in the cylinder, the main body having an axis and opposing first end and second end located on the axis, the lever being traverse to a direction in which the axis extends and pivoted on the first end of the main body, the lever being operable to drive the piston member to move along the axis, one end of the piston member being formed with a conical expander; and

a die set disposed at the second end of the main body and having a plurality of die elements arranged around the axis;

wherein, the conical expander of the piston member is actuated to move axially and outwardly so as to radially drive the die elements to flare the hollow malleable tubular member;

wherein the piston member includes a plug portion which is entirely received within the main body and a body portion extended from the plug portion toward the die elements; the conical expander is disposed on the body portion;

wherein the plug portion includes first and second recesses at opposite ends thereof along the axis, the body portion is detachably assembled in the first recess within the main body, and the second recess is open toward the first end.

2. The flaring device as claimed in claim **1**, wherein the hydraulically powered assembly includes a liquid container being traverse to the axis and extended from the main body; the liquid container controllably communicates with the cylinder in fluid flowing relationship.

3. The flaring device as claimed in claim **2**, wherein the liquid container is detachable from the main body.

4. The flaring device as claimed in claim **1**, wherein the second end of the main body has a connecting portion non-rotatably assembled to the cylinder; the die set is disposed at one end of the connecting portion.

5. The flaring device as claimed in claim **4**, wherein an external screw portion is formed on one end of the connecting portion, an internal screw portion is formed on an internal wall of the cylinder, at least one fastener is radially screwed through the internal screw portion and abutted against the external screw portion.

6. The flaring device as claimed in claim **1**, wherein the die set includes a die element supporter; the die element supporter is connected to the second end of the main body and has a through hole opened thereon; the die elements are clipped between the main body and the die element supporter; the die elements are radially movable and pass through the through hole.

7. The flaring device as claimed in claim **6**, wherein at least one first positioning structure is disposed on a periphery of the through hole; at least one of the die elements has at least one second positioning structure disposed radially thereon; the first positioning structure corresponds to the second positioning structure, and the first positioning structure and the second positioning structure are circumferentially limitably movable and blockable via abutting against with each other.

8. The flaring device as claimed in claim **1**, wherein the die set has an annular wall extended radially inwardly; a recess is formed on a periphery of each die element; the annular wall is at least partially extended into the recess.

9. The flaring device as claimed in claim **1**, wherein a radial tapered portion is formed on a periphery of one end of each die element which is remote from the main body.

10. The flaring device as claimed in claim **1**, wherein the first recess has a depth less than that of the second recess, and the first recess has a width greater than that of the second recess.

* * * * *